



**2003 AFCEE Technology Transfer Workshop**

San Antonio, Texas

*Promoting Readiness through Environmental Stewardship*

# **Principles and Practices Manual for Enhanced Anaerobic Bioremediation**

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# Overview

- Background
- Compelling Questions
- Issues Addressed
- Project Team
- Summary of Goals



# Background

- Chlorinated ethenes (TCE/PCE) in groundwater
  - Technical and costly challenge
  - Air Force has challenged the 5 ppb standard
  - EPA considers TCE 5-65 times more toxic now than before – Go Figure
  - Innovative solutions now even more important



# Background (Cont)

- AFCEE has focused on this problem since 1993
  - Teamed with industry, academia, and EPA
  - Developed MNA protocol for chlorinated solvents (1995)
    - Became EPA document 3 years later following intense negotiation
  - Documented and institutionalized mechanisms responsible for natural breakdown of chlorinated ethenes
  - This work, together with that of numerous institutions and research organizations:
    - Lead to knowledge not even understood a decade ago
    - Directly applicable to enhancing the natural processes



# Background (Cont)

- Primary breakdown mechanism is reductive dechlorination
  - Replace chlorine ions with hydrogen ions
  - Produce hydrogen ions through fermentation of organic substrates
  - Biological electron transfer requires the correct biological community
  - Most significant problem is partial dechlorination
    - Inadequate donor
    - Inadequate microbiology



# Background (Cont)

- Vendors have responded to the problem
- They offer proprietary organic substrates and/or proprietary microbial populations



# The Problem

- How does the DoD project manager determine if this technology is needed or appropriate?
- How does the DoD project manager determine which process or vendor to use?
- How does the DoD project manager know if a process will work?
- How does the DoD project manager make an informed decision?
- This is the purpose of the *Principles and Practices Manual for Enhanced Anaerobic Bioremediation*





# Compelling Questions

- Will MNA be adequate at the site or is augmentation with substrate or microorganisms necessary?
- Which organic substrate should be added or does it make a difference?
- If you add a “best” substrate, will the site eventually completely dechlorinate or will it stop or stall at a daughter product?



# Compelling Questions (Cont)

- If there is adequate substrate present will the native microbial community be adequate to facilitate complete dechlorination or will a microbial injection be necessary?
- Does a particular site favor a particular substrate and/or microorganism and how do you tell?
- With vendors offering different proprietary solutions how does the project manager sort this all out?
- Will this Principles and Practices Manual sort it all out for you?
  - That is the overall goal



# Issues Addressed

- Site selection criteria
- Design methodology
- Regulator acceptance and permitting
- Interphase mass transfer
- DNAPL remediation
- Hydrogeology, microbiology, geochemistry
- Secondary degradation of groundwater quality
- Production of noxious gases

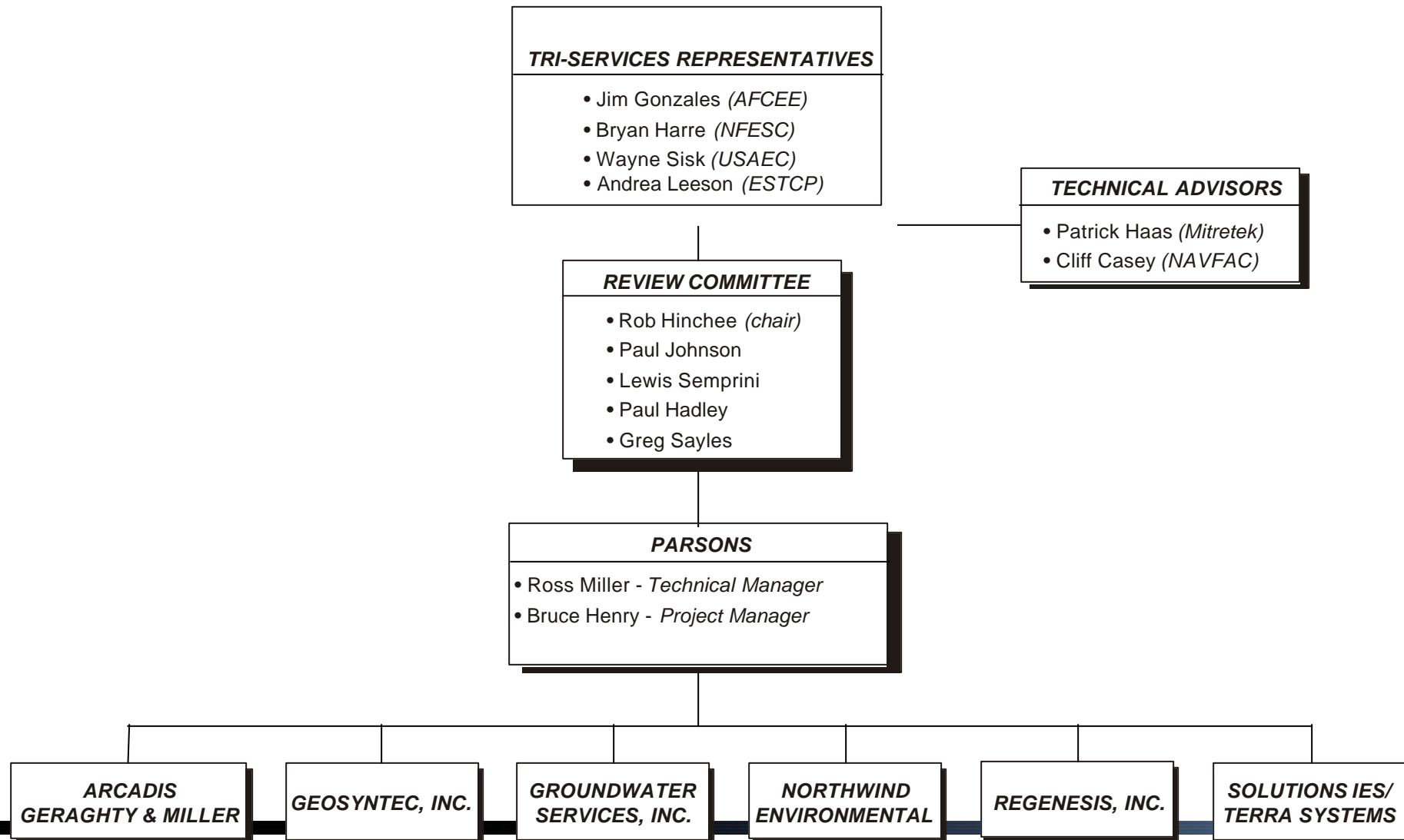


# Project Team

- Project is funded by AFCEE/ERS
- Tri-Service Manual with an oversight board made up from all of the services and ESTCP
- Document will be available through the services and ESTCP
- Conflict-of-interest free advisors to the Tri-Service Board
- Document produced by Parsons with input from Vendors
- Review committee to oversee production of the manual



# Project Team (Cont)



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# Goals for the Manual

- Answer the compelling questions
- Provide a clear path forward for DoD Project Managers

## The Challenge

- Reach consensus among the sponsors, advisors, authors, vendors, and the review committee
- Deliver this all by October, 2003